Critical Care

COMMENT

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Red blood cell transfusion in brain injury: Is it solely a matter of hemoglobin threshold?

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To the editor,

The optimal transfusion strategy for patients with acute brain injury remains a topic of intense debate. Recent large scale randomized controlled trials, such as HEMOTION study, have compared restrictive versus liberal transfusion thresholds [1]. While the TRA4IN study suggested that a more liberal threshold (9 g/dL) was associated with better neurological outcomes, HEMOTION study, focusing specifically on moderate-to-severe traumatic brain injury, failed to demonstrate a significant difference between liberal (10 g/dL) and restrictive (7 g/dL) strategies [2].

However, these studies primarily focused on the hemoglobin threshold, neglecting a potentially critical factor: the age of transfused red blood cells (RBC). Accumulating evidence suggests that the storage time of RBC can significantly impact their functional properties, including oxygen carrying capacity and ability to modulate inflammation [3] [4]. Storage lesions of red blood cell are proportional to storage duration [5]. Additionally, the number of days beyond which a RBC unit is considered old differs among studies.

Large meta-analyses of medical patients have yielded inconsistent results regarding the impact of fresh blood component transfusion on in-hospital mortality, failing to provide conclusive evidence of a survival benefit [6]. Yet, limited clinical data exists specifically linking RBC age to neurological outcomes in acute brain injury. Although a few smaller studies have explored this relationship, the results have not been conclusive in small numbers of patients [7] [8].

The evidence regarding this question is heterogeneous, with studies reporting conflicting findings in diverse population. Considering the susceptibility of the injured brain to hypoxic damage and given the lack of a universal threshold for significantly impaired oxygen carrying capacity, the age of RBC remains a critical variable.

The discrepancy between the TRAIN and HEMOTION studies may be partially explained by differences in the age of transfused RBC despite differences between inclusion criteria. It is plausible that the beneficial effects observed in the TRAIN study were not solely due to the higher hemoglobin threshold but also to the use of younger RBC with potentially superior oxygen carrying capacity.

Therefore, future studies should collect data on RBC age and explore its potential impact on neurological outcomes in acute brain injury. Randomized controlled trials specifically designed to evaluate the effects of RBC age, in combination with different hemoglobin thresholds, are needed to provide more definitive evidence.

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Declarations

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Not applicable.

Competing interests
The authors declare no competing interests.

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